Partial English translation of JPA2000-052289

[0003]

[Means for Solving the Problems]

There are three problems with the above-mentioned operation of the microscope as follows.

1) In the image pickup by a microscope, an image can be obtained only from one direction. Therefore, the entire three-dimensional shape cannot be easily grasped.

2) In daily life, an object can be observed from various directions depending on the operations of the head of a user, and parallactic three-dimensional image recognition effectively works, thereby successfully grasping a three-dimensional shape from sequential images. However, since sequential images depending on the movements of the head cannot be obtained from microscopic images, a grasped shape looks unnatural.

3) Since the feeling of an operation obtained from an enlarged image of the microscope does not match the feeling of a subtle hand operation, an unnatural feeling of an operation arises.

[0004]

To solve the above-mentioned problems, the present invention uses the following means. First, for 1) the restriction of the line of sight, a multidirectional microvisual and optical system is developed to capture

an image of a fine object from various directions and perform the image in a three-dimensional image recognizing process, thereby measuring the image of the three-dimensional shape of the object. At this time, by multidirectional image measurement, an image of the portion hidden when the object is viewed from limited directions can be obtained, thereby obtaining an almost perfect three-dimensional shape. Furthermore, with the three-dimensional shape model by image measurement, the pattern of the surface of an object and the color are also added to the model. Thus, a more realistic image of the object can be restructured. The restructure of the image is realized by a computer graphics method.

[0005]

For the problem that the grasped shape looks unnatural because 2) sequential images cannot be obtained depending on the movement of the head of a user, the position and direction of the head are observed by a magnetic position sensor, etc., and based on the observation, the visual angle of an image generated by computer graphics is determined, and the image is displayed, thereby solving the problem.

[0006]

In addition, relating to the point of 3) the magnification of an image and different feelings of operations, the operating action of a user is reduced based on the magnification of an image using a

teleoperation device and an actual equipment operation is performed, thereby operating the object as if it were an object of an actual size in daily life.

[0007]

To solve the above-mentioned technological problems, the document "Virtualized Reality" in the publication "bit", pages 4 to 12, Feb., 1996 describes the problem 1) above by referring to a soft-camera for the observation from various directions and examples of generating an image with the internal model configuration of a computer. However, a target object is not an enlarged image produced for microoperation, etc. Furthermore, for grasping an object in a natural three-dimensional array, it is necessary to generate parallactic images and also generate sequential images depending on the movements of the head of a user.

[0008]

An example of presenting a model by displaying sequential images depending on the movements of the head of a user can also be presented by design evaluation by applying virtual reality by a kitchen experience system based on the artificial reality described on pages 1352 to 1355, vol. 57, No. 8 (1991) of the publication by the Institute of Exact Engineering. However, for consistency with the human sense, it is necessary to generate an image from an

actual model based on the measurement of an image for an actual target operation.

[0009]

The study of a teleoperation is described in various publications such as the document of the robot engineering handbook, pages 723 to 729 (Ohmsha, 1990), etc. However, for actual operations, it is necessary to attain the consistency in feeling of an operation by obtaining a matching ratio with a presented enlarged image from an actual image model. Furthermore, by a combination with a force feedback in consideration of a magnification ratio, a natural feeling of an operation for a user can be obtained.

[0010]

The present invention aims at attaining natural feeling of an operation in daily life from a microoperation using a microscope that requires a subtle operation of a user by introducing the above-mentioned technologies to a system.

[0016]

The technology developed in the teleoperation can be applied in the operation on the image. For example, the document of the virtual technology laboratory, p. 10 (Institute of Technological Study, 1992) introduces the operation equipment as shown in Figure 7. This device realizes high accuracy measurement of the movement of the arm of a user on the spatial position and posture. The present invention transmits the movement of the hand to the controller of the microoperation equipment. The controller reduces the operation of the arm according to the magnification on the image display, and defines the operation of an operation mechanism, for manipulating a target object. A practical operation is based on the movement of a knife, pincers, etc. for use in manipulating an object, a three-dimensional image display unit displays assumed enlarged models of them, and a target object is handled by assuming an operation using them.